

Hydrometrics, Inc.

# Baseline Sound Investigation Santa Fe Pacific Gold, Elkhorn Project Jefferson County, Montana

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STATE LANDS

**BASELINE SOUND INVESTIGATION**  
**ELKHORN PROJECT**  
**JEFFERSON COUNTY, MONTANA**

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**BASELINE SOUND INVESTIGATION**  
**ELKHORN PROJECT**  
**JEFFERSON COUNTY, MONTANA**

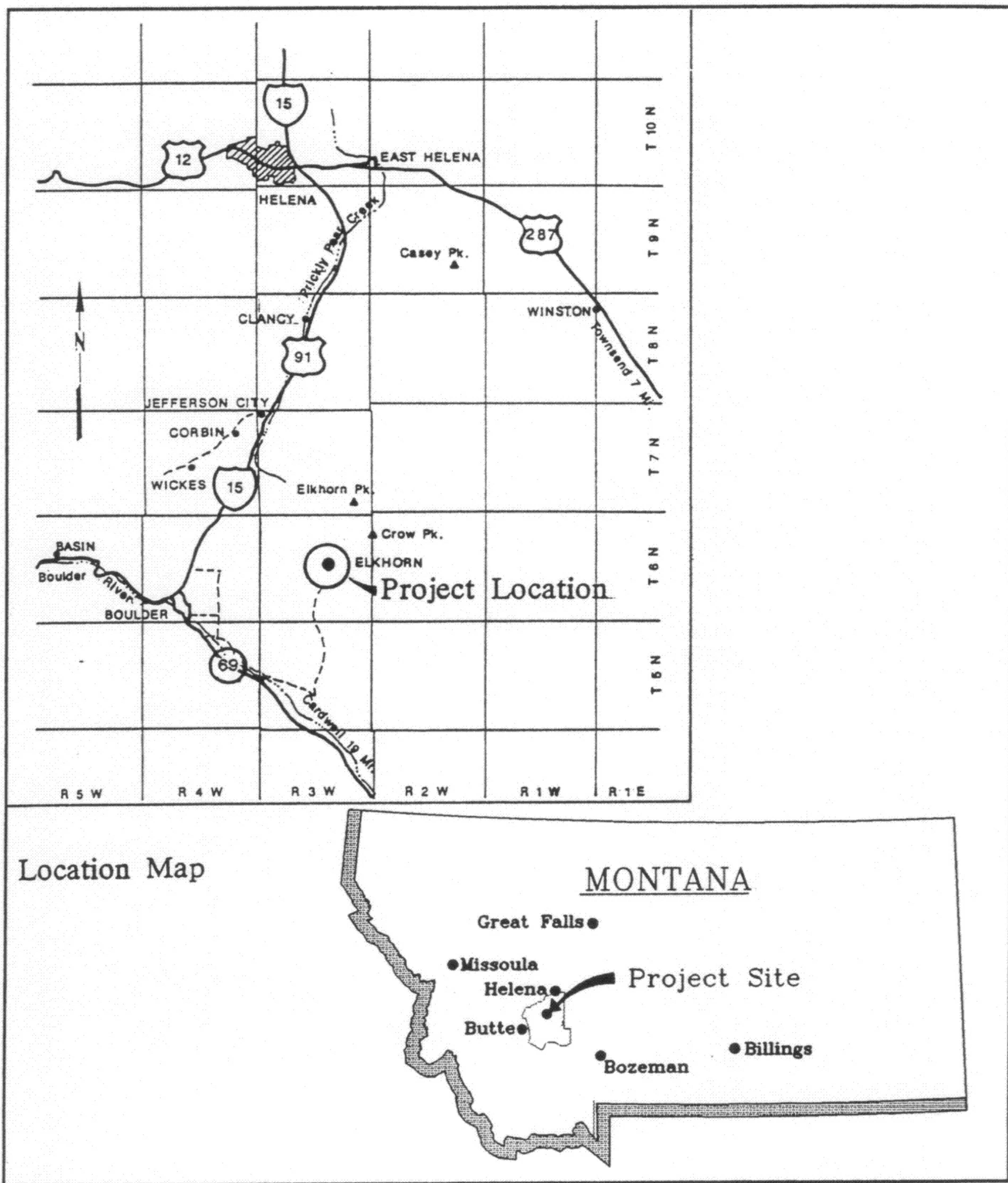
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**1.0 INTRODUCTION**

Santa Fe Pacific Gold Corporation (Santa Fe) has proposed development of a gold mine and ore processing facility near the Elkhorn townsite in Jefferson County, Montana (Figure 1). The proposed Elkhorn Project would be located on patented and unpatented mining claims, U.S. Forest Service, Bureau of Land Management, and private lands.

The baseline sound investigation documents sound levels for areas in and near the proposed Elkhorn Project, and evaluates the potential for increases in these levels related to development and operation of the proposed mine. Existing sound levels and potential sound associated with the Elkhorn Project must be characterized for the area to meet agency requirements for a mine operating permit. This baseline information may also then be used to prepare an Environmental Impact Statement (EIS) in compliance with the Montana Environmental Policy Act (MEPA) and the National Environmental Policy Act (NEPA). This report describes the methodology used and the results obtained during the baseline sound investigation.





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*Figure 1*  
*Regional Location Map*  
*Elkhorn Project, Jefferson County, Montana*

*Santa Fe Pacific Gold Corporation*



## 2.0 AMBIENT SOUND LEVELS

### 2.1 METHODOLOGY

A-weighted sound levels were measured at 10 sites within the project area (Figure 2) during October 1993. All baseline sound measurements were obtained using a Quest Electronics precision sound level meter Model 1800, and a free field microphone with wind screen. Wind and atmospheric conditions were documented during each sampling episode. The instrument was acoustically calibrated using a Quest QC-20 calibrator prior to the beginning of testing, and internally calibrated each day before and after the testing period. The calibrator was calibrated at the factory within the past year.

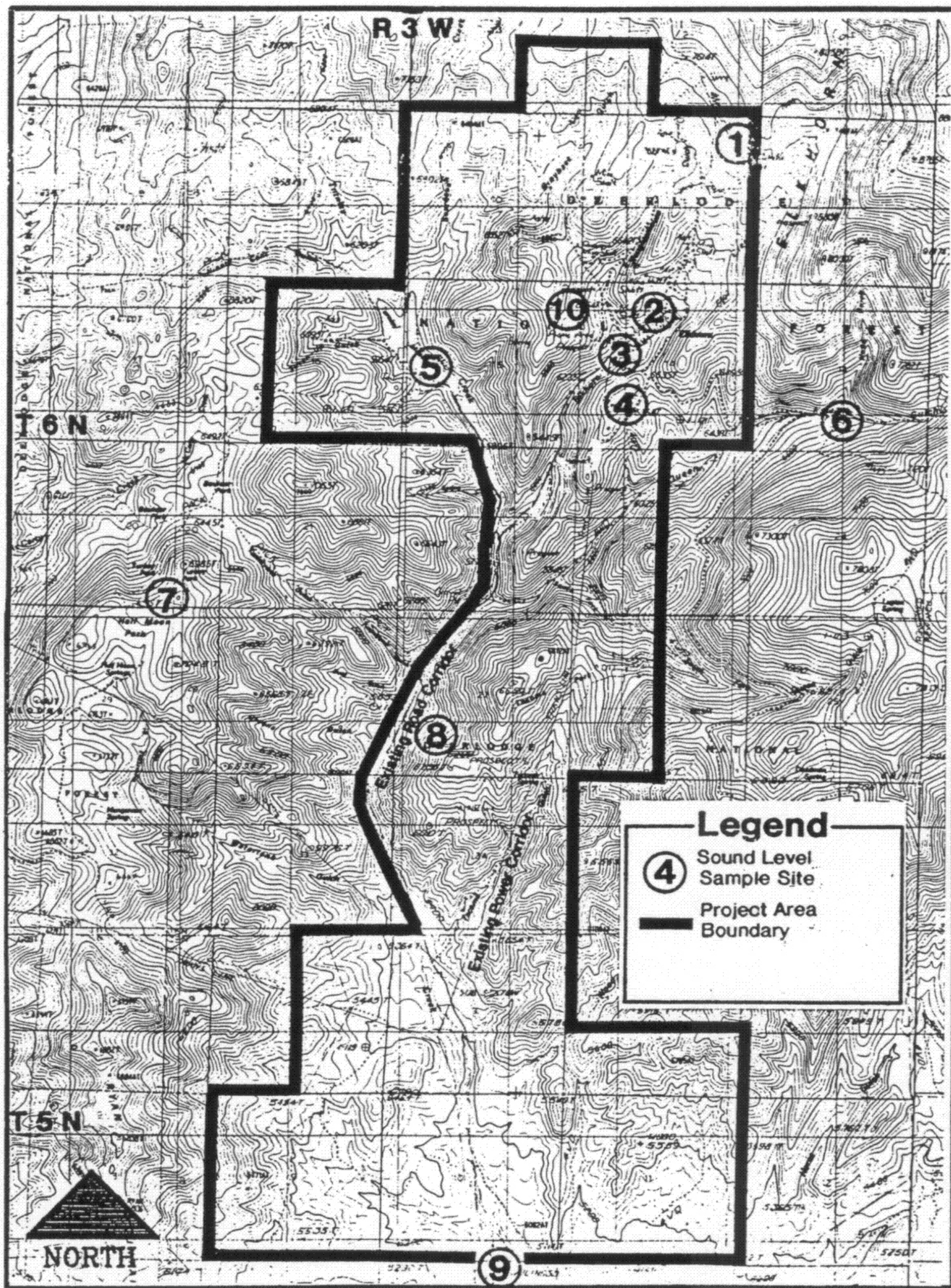
All sound measurements were taken with the A - Scale meter function set at "fast". Most equivalent sound levels ( $L_{eq}$ ) were taken using 10 minute time periods. The minimum and maximum sound levels during the 10 minute time period also were documented.

Baseline equivalent sound levels ( $L_{eq}$ ) were obtained during daytime at all sample sites, and baseline nighttime sound levels were obtained at sample sites 2 and 8. Day-night sound levels ( $L_{dn}$ ) were estimated at these two sites by averaging daytime  $L_{eq}$  and nighttime  $L_{eq}$ , with an additional 10 dBA weighting being added to the nighttime  $L_{eq}$  (EPA 1978). The nighttime  $L_{eq}$  was taken between the hours of 10:00 PM and 7:00 AM.

Sound from exploration drilling activity being conducted by Santa Fe in the vicinity of the Elkhorn townsite was included as an additional component in the baseline investigation. Sound levels were measured at a distance of 50 feet away from the exploration drilling activity (sample site 10) and measured at sample sites 1, 2, 3, 4, 5, and 6 while exploration drilling was being conducted. This was done to assess potential sound attenuation due to topography and vegetation.

Specific location descriptions and field conditions of sound measurement sites used in this study are in Appendix 1. The results are described in the following sections.





Scale: 1" = 5000'

31294H03

**Figure 2**  
**Sound Level Sample Sites**  
**Santa Fe Pacific Gold Corporation**  
**Elkhorn Project**  
**Jefferson County, Montana**



## 2.2 EVALUATION OF AMBIENT SOUND LEVELS

Ambient daytime and nighttime sound levels measured at all sample sites are in Table 1. The daytime  $L_{eq}$  and  $L_{dn}$  values for the Elkhorn Project area were then compared with ambient  $L_{dn}$  levels described by EPA (1978) on Figure 3.

### 2.2.1 Day-Night Ambient Sound Levels ( $L_{dn}$ )

Night and daytime sound levels were measured at sample sites 2 (Elkhorn townsite) and 8 (midpoint of project area), and ambient day-night sound levels ( $L_{dn}$ ) were calculated. These sites (Figure 2) were selected for nighttime measurements because of their proximity to seasonal residences.

The ambient  $L_{dn}$  level at sample site 2 was 38.4 dBA, which is in the expected range for a wilderness/rural residential setting (Figure 3). During the period that the daytime sound measurement was taken at site 2, daily activity at the townsite consisted of renovation of two historical buildings and a small amount of vehicular traffic from both permanent residents and visitors to the area.

The ambient  $L_{dn}$  level at sample site 8 was 44.0 dBA, which is within the expected range for agricultural crop land (Figure 3). A baseline  $L_{dn}$  was calculated for this site because of the presence of a recreational cabin in this area. The  $L_{dn}$  also may be elevated at this site because of sound produced from nearby Elkhorn Creek.

### 2.2.2 Daytime Ambient Sound Levels

The ambient daytime  $L_{eq}$  at all sample sites showed expected variability caused by environmental conditions such as wind, movement of the nearby vegetation, rain, wildlife, flowing streams, and other factors (see description of site conditions in Appendix 1). In comparison with the sound levels in Figure 3, all data for the sample sites (Table 1) would be within or close to the expected range of sound levels for wilderness except site 3 (Picnic Area), site 6 (Queen Gulch), and site 9 (proposed mine facilities area south of townsite).



**TABLE 1. BASELINE SOUND LEVEL MEASUREMENTS  
1993 - SANTA FE PACIFIC GOLD CORPORATION  
ELKHORN PROJECT  
JEFFERSON COUNTY, MONTANA**

Site Number (from Figure 2)	Measurement Date and Time	dBA Range	L <sub>eq</sub> (10 min)*
1	10/11/93 (ambient) 2:48 p.m. to 2:58 p.m.	25.6 - 64.2	32.9
	10/05/93 (exploration drilling) 3:09 p.m. to 3:19 p.m.	28.2 - 53.7	40.4
2	10/11/93 (ambient) 2:19 p.m. to 2:29 p.m.	23.7 - 58.6	34.7
	10/05/93 (exploration drilling) 8:20 p.m. to 8:35 p.m.	35.3 - 68.3	48.4
	10/25/93 (nighttime) 6:30 a.m. to 6:40 a.m.	23.3 - 61.2	32.1
3	10/11/93 (ambient) 11:10 a.m. to 11:20 a.m.	41.3 - 52.6	43.1
	10/05/93 (exploration drilling) 1:36 p.m. to 1:46 p.m.	40.2 - 64.2	46.1
4	10/11/93 (ambient) 11:39 a.m. to 11:49 a.m.	22.2 - 50.7	25.3
	10/05/93 (exploration drilling) 2:34 p.m. to 2:44 p.m.	23.3 - 41.0	26.1
5	10/11/93 (ambient) 4:06 p.m. to 4:16 p.m.	31.2 - 57.1	35.5
	10/05/93 (exploration drilling) 4:37 p.m. to 4:47 p.m.	27.8 - 46.2	31.8

\* dBA



TABLE 1 (Continued). BASELINE SOUND LEVEL MEASUREMENTS

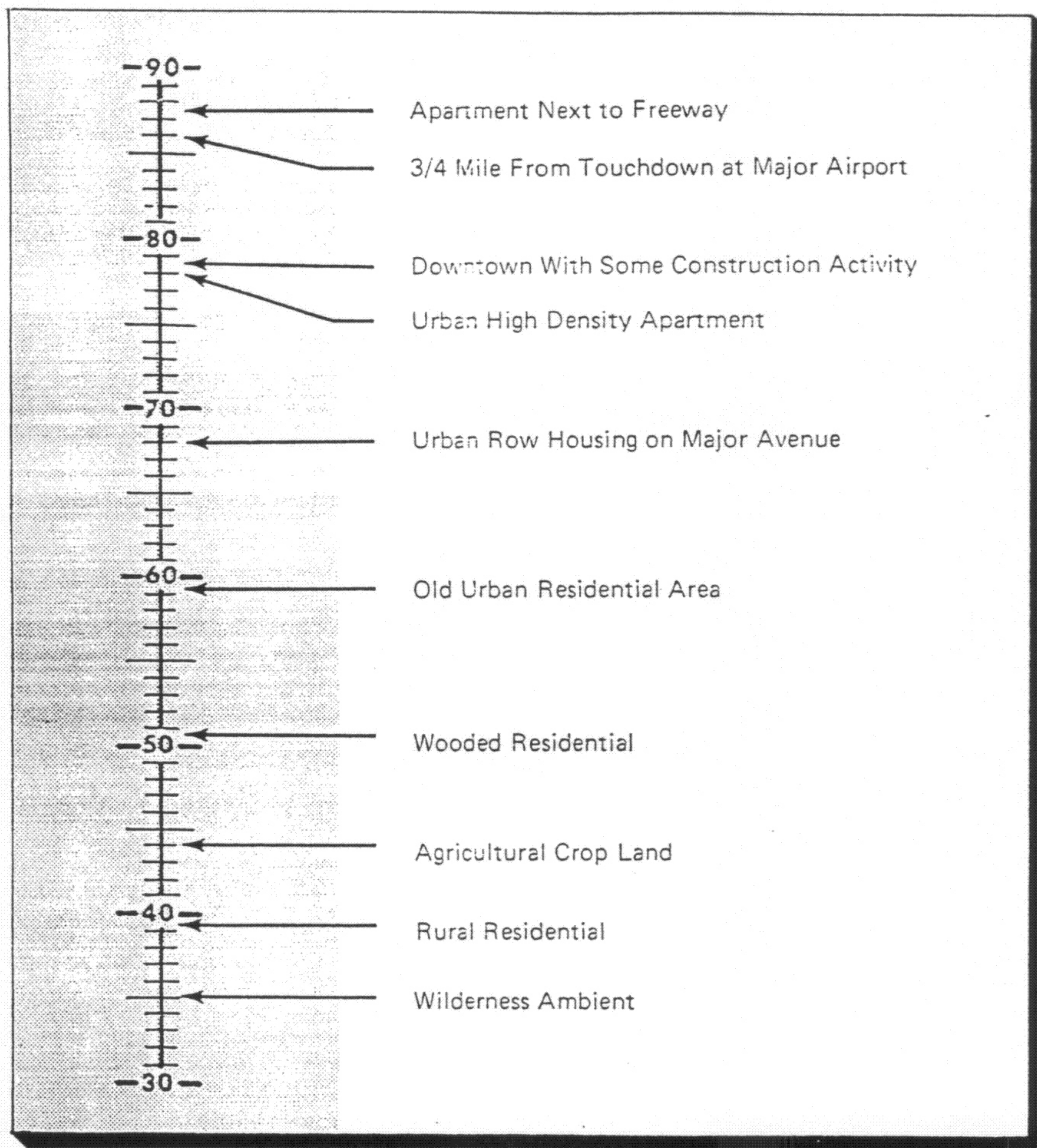
Site Number (from Figure 2)	Measurement Date and Time	dBA Range	L <sub>eq</sub> (10 min)*
6	10/11/93 (ambient) 3:32 p.m. to 3:38 p.m.	40.2 - 67.6	47.7
	10/05/93 (exploration drilling) 3:52 p.m. to 4:02 p.m.	38.3 - 44.3	39.6
7	10/22/93 (ambient) 1:10 p.m. to 1:20 p.m.	23.0 - 50.3	29.2
8	10/11/93 (ambient) 4:34 p.m. to 4:44 p.m.	37.6 - 51.1	38.8
	10/25/93 (nighttime) 6:50 a.m. to 5:56 a.m.	37.6 - 53.7	39.2
9	10/11/93 (ambient) 4:59 p.m. to 5:09 p.m.	27.1 - 56.7	41.3
10	10/05/93 (exploration drilling) 12:58 p.m. to 1:08 p.m.	73.8 - 79.4	51.7

\* dBA



L<sub>dn</sub> in dB

## Outdoor Location



Source: EPA Publication - Protective Noise Levels Nov. 1978

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**Figure 3**  
**Examples of Outdoor Day-Night Average**  
**Sound Levels in dB Measured at Various Locations**  
*Santa Fe Pacific Gold Corporation*  
*Elkhorn Project*  
*Jefferson County, Montana*



Site 3 was adjacent to Elkhorn Creek and site 6 was adjacent to the creek in Queen Gulch which, in both cases, increased sound levels due to flowing water. At site 9, the sound measurement was taken in the evening and insects (cicadas) caused an increase in background sound level. The  $L_{eq}$  for sites 3 and 6 is within the expected range for agricultural crop land, and  $L_{eq}$  for site 9 is within the expected range for rural residential.

### 2.2.3 Exploration Drilling Activity Sound Levels

Measurement of background sound levels at sample sites during exploration drilling activities was used to assess the approximate attenuation of sound by terrain, ground cover, and manmade structures. This was accomplished by measuring starting point sound levels 50 feet from the drilling equipment, then measuring sound levels (during drilling operations) at sample locations 1, 2, 3, 4, 5, and 6. The sound values at sites 1, 2, 3, 4, 5, and 6 (Table 1) were then compared with the theoretical sound that would be expected solely due to distance away from the sound source (i.e., sound reduction). The theoretical sound values were determined from the free field calculation. Free field sound reductions were calculated using the following formula:

$$L_p = L_x - 20[\log_{10}(r_p/r_x)]$$

where:  $L_p$  = dBA at distance  $r_p$  from sound source  
 $L_x$  = dBA at distance  $r_x$  from sound source

The minimum sound level measured during the 10 minute sampling period was used to represent drilling sound because the  $L_{eq}$  was influenced by construction activities, vehicular traffic, wind, and wildlife. The location of the drilling operation is sample site 10 (Figure 2).



### **3.0 ESTIMATED SOUND IMPACT FROM MINING ACTIVITY**

The proposed mining and ore processing activities of the Elkhorn Project would add to the area's baseline sound levels. Blasting, heavy equipment operation, vehicle traffic, ore handling, and crusher operation would all generate sound. The highest sound levels are expected to occur during short periods when blasting occurs at or near the surface.

A true assessment of potential sound impact from the Elkhorn Project can only be made after mine plans have been further developed and locations of facilities are known. Operation of the Elkhorn Project would be subject to applicable sound level regulations of the U.S. Department of Labor, Mine Safety and Health Administration (MSHA) established to assure personal protection, health, and welfare of employees at mine sites.

Actual sound values from existing hard rock mine operations are described below. This information is used along with measured ambient sound levels and appropriate attenuation factors to estimate potential sound levels with distance for the Elkhorn Project.

#### **3.1 MINING EQUIPMENT AND BLASTING SOUND**

Construction sound from trucks, bulldozers, loaders, and drills would typically generate sound levels in the range of 85 to 90 dBA at 50 feet (Table 2). Actual measurements taken near the crusher facility at the Troy - ASARCO mine indicated sound levels at 90 dBA (Troy Mine, 1987. ASARCO Internal Report).

Blasting would typically generate sound levels ranging from 115 to 125 dB at 900 feet from the source (Table 2). Blasting measurements taken at the Kendall Venture (now called CR Kendall) showed sound levels of 64 to 77 dBA at approximately 600 feet from the blast (Kendall Venture Mine, 1989. Kendall Internal Report). A blast at the Zortman mine site measured sound levels at less than 110 dBA approximately 900 feet from the source (Zortman-Landusky Mine, 1990. Pegasus Gold Internal Report).



**TABLE 2. TYPICAL SOUND LEVELS FOR  
EQUIPMENT AND MINE OPERATIONS**

	<u>Sound Level dB(A) at Distance</u>	<u>Source</u>
Haul truck	90 @ 50 ft.	U.S. EPA 1978
Bulldozer	85 @ 50 ft.	Reagan and Grant 1977
Loader	87 @ 50 ft.	Reagan and Grant 1977
Blasthole Drill	86 @ 50 ft.	Reagan and Grant 1977
Blasting	115-125 @ 900 ft.	U.S. Bureau of Mines 1976

*(Source: CBMI (1990). Application for a Hard Rock Mining Operating Permit and Proposed Plan of Operation, New World Project, November, 1990)*

### **3.2 ESTIMATED SOUND CONTOUR**

A sound contour is a line of equal sound level surrounding a sound source. The shape of sound contours around a mine site will vary with topography, wind and atmospheric conditions. Theoretical contours of sound level with radial distance from a sound source can be estimated for the Elkhorn Project based on sound generated at other Montana mines operating in somewhat comparable terrain, measurements of sound levels in Table 2, and extrapolating "worst case" situations (i.e. using maximum or higher levels than those measured at Elkhorn). For example, a theoretical sound level contour of 55 dBA ( $L_{55}$ ) was calculated for the Elkhorn Project area assuming free field transmission characteristics and ignoring the effects of topography. The assumption made in the calculations result in higher than actual (i.e. conservative estimate) measured sound levels, but are useful to assess a worst-case impact of mine operation sound levels in the area surrounding the Elkhorn Project.

Construction sound from trucks, bulldozers, loaders, and drills would typically generate sound levels in the range of 85 to 90 dBA at 50 feet (Table 2). Using a conservative value of 95 dBA at 50 feet, the free field  $L_{55}$  dBA contour for equipment sound would be 5,000 feet radially away from the sound source.



Sound levels will be highest during blasting operations; however, sound produced from blasting is short in duration. Blasting measurements taken at the Kendall Venture (now called CR Kendall) indicated sound levels of 64 to 77 dBA approximately 600 feet from the blast. Assuming above-ground blasting sound levels of 77 dBA at 600 feet, the free field  $L_{55}$  dBA contour is calculated to be approximately 7,554 feet (1.4 miles) radially away from the sound source.

A blast at the Zortman mine site had measured sound levels of 89.1 dBA at approximately one mile from the site and 65.0 dBA at approximately 2.5 miles from the site (Zortman-Landusky Mine, 1990. Pegasus Gold Internal Report). Using free field calculations, the sound levels of 89.1 dBA (measured at one mile from the site) would theoretically be reduced to 81.1 dBA at 2.5 miles from the site. This theoretical value is much higher than the actual measured sound level of 65.0 dBA at the same distance, and indicates that actual sound levels can decrease more rapidly with distance than free field calculations would suggest. The difference in theoretical versus actual sound levels are believed to be due to the absorptive effects of the terrain and ground cover. The theoretical free field  $L_{55}$  dBA sound contour would be approximately 8 miles radially away from the sound source using blast sound level of 65.0 dBA at 2.5 miles.

### **3.3 PROJECTED SOUND LEVELS AT ELKHORN PROJECT SAMPLE SITES**

The most critical component affecting sound levels at sites within the Elkhorn Project area is the location of the sound sources. Since the mine plan for Elkhorn has not been fully developed, sound source locations are still uncertain.

The Elkhorn Project area is mountainous and heavily timbered. Therefore, construction and operational sound at the Elkhorn Project would be attenuated with distance by surrounding vegetation, standing timber, and mountainous topography. Wind direction and velocity also are important in sound transmission and attenuation (Beranek, 1949).

Sample site 1 overlooks Elkhorn townsite from the north (Figure 2) and should be within line-of-sight of most of the proposed operations. Sound levels at this location should be under 60 dBA for sound produced from mining equipment, and less than 111 dBA during blasting operations, based on free field calculations.



Of the locations measured in this study, sound levels at sample sites 2 and 3 located within the Elkhorn townsite (Figure 2) are expected to be the most impacted by mine related activities. Both sites are located adjacent to a proposed pit area (pers. comm. Santa Fe). At the start of excavation, maximum sound levels due to excavation equipment may reach 79 dBA at sample site 2, and 71 dBA at sample site 3. As the pit is deepened and activity is confined within the pit, the sound levels should decrease. Maximum sound levels due to blasting may initially be within the 77 to 125 dBA range at both sample sites 2 and 3 since they are within approximately 900 feet of the proposed pit.

Sample site 4 south of Elkhorn townsite is near the top of a hill (Figure 2), facing away from proposed mining activity (pers. comm. Santa Fe). The free field sound calculation from mining equipment operations in the closest proposed open pit is 64 dBA. Using the calculated attenuation factor measured during the drilling activity, the sound levels at this site should not exceed 47 dBA from mining equipment. Using the same criteria, the sound levels should not exceed 96 dBA during blasting.

Sample site 5 is in Turnley Meadows (Figure 2) and is located away from proposed open pit activities; however, an overburden stockpile was proposed within 250 feet of this location (pers. comm. Santa Fe). Sound from periodic truck traffic along with sound generated from bulldozer operations may impact this location. Truck traffic should be in the line-of-sight of site 5 when trucks are at the edge of the pile and the bulldozer could always be in the line-of-sight. Estimated sound levels from equipment at site 5 should have peaks less than 55 dBA. The nearest proposed open pit is approximately 4,250 feet from site 5 and free field calculations indicate blasting sound levels peaking at 112 dBA. However, there is a hill between sample site 5 and the proposed pit which would attenuate blasting sound. The calculated attenuation factor from drilling operations at site 5 is approximately 10 dBA, bringing estimated peak blasting sound levels at this site to less than 102 dBA.

Sample site 6 is in Queen Gulch (Figure 2) next to a creek with no line-of-sight to proposed mine facilities. The sound produced from the creek is likely to mask most sound created from mine equipment. However, depending on atmospheric conditions, sound created from



blasting should be distinguishable from sound produced by the creek. The sound produced by the creek masked any sound produced from recent exploration drilling activities. Therefore, calculation of drilling sound attenuation was not performed.

Sample site 7 is in the Half Moon Park area approximately 2 miles southwest of the proposed mine site (Figure 2), and there is mountainous terrain between this location and proposed mine facilities. Although there should be considerable attenuation depending on atmospheric conditions, mine equipment and blasting sound may be distinguishable at this site.

Sample site 8 is next to a cabin and Elkhorn Creek in the center of the project area (Figure 2). Free field calculation for sound generated from mining equipment at sample site 8 is approximately 48 dBA and sound from the creek at this location is approximately 37.6 dBA. This location is south of the proposed mining operation, and sound from mine activities should be attenuated by the twisting canyon and presence of trees. No sound level measurements were taken at the site during exploration drilling operations, and no attenuation factor was calculated. Sound from mining equipment may be distinguishable at this location under certain atmospheric conditions. The free field calculation for blasting is 101 dBA. Actual blasting sound at this site is expected to be attenuated below this calculated level, but should be distinguishable from creek sounds.

Sample site 9 also is south of Elkhorn townsite near the southern project area boundary (Figure 2). Sound from mining activities near the townsite should be attenuated along the Elkhorn Creek drainage by the twisting canyon and trees. When sound levels at sample site 9 were measured, the cicadas (insects) were very active with sound peaks up to 51.1 dBA. Free field calculations for mining equipment sound at this location is 40 dBA. During times when they are active, sound from the cicadas would likely mask any sound generated by mining equipment, and it is questionable whether mining equipment sound would be distinguishable during periods when cicadas are not active (minimum sound levels at site 9 measured 27.1 dBA). The free field sound level for blasting is calculated to be 95 dBA at this location. During certain atmospheric conditions, and depending on the attenuation factor, blasting may be distinguishable.



#### 4.0 CONCLUSION

The areas that would be most impacted by sounds produced from the proposed Elkhorn Project are Elkhorn townsite and areas within line-of-sight of mining activities. Both mining equipment and blasting sounds will likely be distinguishable in line-of-sight areas used in this study.

The impact from sounds produced from the mining activities will decrease with distance. The theoretical  $L_{55}$  sound contour is conservatively estimated to be 5,000 feet radially away from earthmoving equipment, and from 1.4 to 8 miles radially away from blasting. Depending on location of facilities, and types and quantities of equipment used on the Elkhorn Project, sounds generated by mining and construction equipment should be attenuated beyond sample site 8 (center of the project area) by vegetation and terrain, and masked by the flowing water of streams. Blasting sounds could be carried further down the Elkhorn Creek drainage, and may be discernible at the southern boundary of the project area, depending on background sound and the size of the blasting charge.

The impact from sounds produced from mining activity at locations outside the Elkhorn Creek drainage and outside the line-of-sight to the mining operation, will decrease at a greater rate because of the terrain. Sample site 7 (outside of the project area) will likely be impacted from sounds produced from the mining operation because it is near the top of a hill which is near to line-of-sight of the mining activities. However, sound levels produced from mining are expected to decrease rapidly in the lower portions of drainage basins, and toward the Boulder Valley.



## 5.0 REFERENCES

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Zortman-Landusky Mine, 1990. Pegasus Gold Internal Report.







**APPENDIX 1.**

**BASELINE SOUND LEVEL MEASUREMENTS - 1993**

**SANTA FE PACIFIC GOLD CORPORATION**

**ELKHORN PROJECT**

**JEFFERSON COUNTY, MONTANA**



## SOUND LEVEL MEASUREMENTS

October 5, 1993

- Site No. 1 Top of hill at Louise Mine. 3:09-3:19 p.m. Wind calm to breezy (up to approximately 10 mph from S.W.). Breezes caused tree sound. Drilling sound was distinguishable. Range 28.2-53.7 dBA.  $L_{eq}$  (10 min) = 40.4 dBA.
- Site No. 2 Elkhorn Townsite. 2:00-2:10 p.m. Slight breeze up from canyon. Construction workers restoring building (sound from electric hand drills and saws); two vehicles passed sample location; can hear diesel engine (Bobcat) running behind structures being renovated; diesel engine (semitruck) idling at Santa Fe's core shed; drilling sound was distinguishable. Range 35.3-68.3 dBA.  $L_{eq}$  (10 min) = 48.4 dBA.
- Site No. 3 Picnic area. 1:36-1:46 p.m. Wind calm. Semi truck drove past on main road; creek flowing through picnic area causing elevated sound levels; drilling sounds barely distinguishable. Range 40.2-64.2 dBA.  $L_{eq}$  (10 min) = 46.1 dBA.
- Site No. 4 Cemetery. 2:34-2:44 p.m. Wind mostly calm with small breezes occasionally coming from west. Jet could be heard towards end of 10 minute sampling period; occasional breezes would cause sound in trees; drilling sounds barely distinguishable. Range 23.3-41.0 dBA.  $L_{eq}$  (10 min) = 26.1 dBA.
- Site No. 5 Turnley Meadows. 4:37-4:47 p.m. Wind calm. Creek at about 100 yards causing sound; could not hear drilling operation. Range 27.8-46.2 dBA.  $L_{eq}$  (10 min) = 31.8 dBA.
- Site No. 6 Queen Gulch, east of mine site. 3:52-4:02 p.m. Wind mostly calm with 2 brief breezes; creek running approximately 75 yards causing sound; could not hear drilling operation. Range 38.3-44.3 dBA.  $L_{eq}$  (10 min) = 39.6 dBA.
- Site No. 10 50 feet from drilling operation. 12:58 a.m.-12:08 p.m. Wind calm. Range 73.8-79.4 dBA.  $L_{eq}$  (10 Min) = 76.2 dBA.



October 11, 1993

- Site No. 1 Top of hill at Louise Mine. 2:48-2:58 p.m. Wind calm; propeller type plane in distance; occasional rifle shots in distance. Range 25.6-64.2 dBA.  $L_{eq}$  (10 min) = 32.9 dBA.
- Site No. 2 Elkhorn townsite. 2:19-2:29 p.m. Breeze coming up canyon, approximately 2-5 mph; construction workers restoring building (plastic cover blowing, electric hand drill); voices from construction workers and visitors at townsite; vehicle drove into picnic area below townsite; four wheel drive sounds in distance; a squirrel was chattering. Range 23.7-58.6 dBA.  $L_{eq}$  (10 min) = 34.7 dBA.
- Site No. 3 Picnic Area. 11:00-11:10 a.m. Wind calm. Creek flowing through picnic area causing elevated sound levels; vehicle drove down road past picnic area; dog was barking somewhere in townsite above picnic area; person was camping in picnic area and drove away in car; resident of townsite started car and drove past picnic area (few car doors slamming). Range 41.3-52.6 dBA.  $L_{eq}$  (10 min) 43.1 dBA.
- Site No. 4 Cemetery. 11:39-11:49 a.m. Wind calm. A squirrel was chattering. Range 22.2-50.7 dBA.  $L_{eq}$  (10 min) = 25.3 dBA.
- Site No. 5 Turnley Meadows. 4:06-4:16 p.m. Wind calm. Creek causing elevated sound levels; raven causing elevated sound levels. Range 31.2-57.1 dBA.  $L_{eq}$  (10 min) = 35.5 dBA.
- Site No. 6 Queen Gulch, east of mine site. 3:32-3:38 p.m. Wind calm. Elevated sound due to creek; rain began 3 minutes into sampling; stopped sampling at 6 minutes due to rain. Range 40.2-67.6 dBA.  $L_{eq}$  (6 min) = 47.7 dBA.
- Site No. 8 Midpoint on access road between mine site and southern border of project study area, near cabin. 4:34-4:44 p.m. Wind calm; creek approximately 30 yards away causing sound; raven causing sound. Range 37.6-51.1 dBA.  $L_{eq}$  (10 min) = 38.8 dBA.
- Site No. 9 South of mine site in alternative facilities area near lower air monitoring station. 4:59-5:09 p.m. Wind calm; cicadas very active, which elevated sound levels. Range 27.1-56.7 dBA.  $L_{eq}$  (10 min) = 41.3 dBA.



October 22, 1993

- Site No. 2      Wind calm. 6:30-6:40 a.m. Wind calm; distant creek sound; cold temperatures caused contraction sounds on sound level meter which increased peak sound levels, but did not significantly affect  $L_{eq}$  results. Range 23.3-61.2 dBA.  $L_{eq}$  (10 min) = 32.1 dBA.
- Site No. 7      Half Moon Park. 1:10-1:20 p.m. Wind mostly calm with breezes less than 5 mph; could hear vehicles from the Boulder Valley below. Range 23.0-50.3 dBA.  $L_{eq}$  (10 min) = 29.2 dBA.
- Site No. 8      Midpoint on access road between mine site and southern border of project study area, near cabin. 6:50-6:56 a.m. Wind calm; stopped sampling period early because of traffic from hunters. Range 37.6-53.7 dBA.  $L_{eq}$  (5 min 43 sec) = 39.2 dBA.